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ABSTRACT

The effects of organizational variables on recall of prose were examined in 48 college-educated adults in three age groups (20 to 33 years, 41 to 55 years, and 58 to 79 years). It was hypothesized that if older adults suffered deficits in organizational processes, they would show lower quantities of prose recall, difficulties in following the text's top-level structure and diminished "levels effects" (information high in the hierarchical text structure is recalled better than information low in the hierarchy). Two experiments tested these implications, using a system of prose analysis to identify text structure. One study focused on age-related differences in the total amount of information remembered and the type of information remembered, while the second study determined whether older subjects exhibited differential recall of prose when the prose was organized according to different top-level structures. No age differences were found in total recall, recall of main ideas, nor use of the text's top-level structure. The young-adult group, however, did exhibit levels effects while the middle and older adult groups did not. The young-adult group recalled significantly more high-level information than low-level information. This difference was attributed to the effects of current schooling practices rather than to organizational or reading comprehension deficits in the aged. (RL)

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The Amount, Type, and Organization of Information Recalled from Prose by Young, Middle, and Old Adult Readers

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Reading Comprehension with Aging

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Abstract

The effects of organizational variables in prose on recall are examined for college-educated adults in three age groups. If older adults suffer a deficit in organizational processes (Craik, 1968), this may be manifest in lower quantities of prose recall, difficulty following the text's top-level structure, and diminished "levels effects" (information high in the hierarchical text structure recalled better than information low). Two experiments test these implications using Meyer's (1975) prose analysis system to identify text structure. No age differences were found in total recall, recall of main ideas, nor use of the text's top-level structure. However, young adults exhibited the typical "levels effects," while middle and old adults did not. This difference was attributed to the effects of current schooling practices on the youngest group, rather than organizational or reading comprehension deficits in the aged.

The Amount, Type, and Organization of Information Recalled from Prose by Young, Middle, and Old Adult Readers

After reading a prose passage, people are unable to remember all of the information it contained. Some information is remembered by almost everyone in a group of readers, whereas other information is remembered by very few readers. The organization of the passage is strongly related to this differential recall of information for groups of college students (Johnson, 1970; Kintsch & Keenan, 1973; Meyer, 1975; Meyer & McConkie, 1973). This study investigates whether there are age-related differences in the quantity and types of information remembered from prose. Specifically, it seeks to determine whether age-related differences in prose recall can be linked to organizational variables in prose.

Research in the area of prose recall has demonstrated that the organization of the ideas in a passage has strong implications for the retention of information from it (Meyer, 1977). In particular, superordinate ideas in a passage with a hierarchically organized content structure are recalled more frequently than the subordinate ideas in the structure (Kintsch, Kozminsky, Streby, McKoon, & Keenan, 1975; Meyer, 1975; Meyer & McConkie, 1973). In addition, well-organized or well-structured passages are better remembered than disorganized ones (Frase, 1969; Kintsch, Mandel, & Kozminsky, 1977; Thorndyke, 1977).

The present studies were designed to test the relative sensitivity of different age groups of adults to the organization of prose passages. If older adults suffer from a deficit in the use of organization, as has been proposed (Craik, 1968; Hultsch, 1971), they may find it difficult to

discover and make use of the hierarchical organization of a prose passage. Very few studies of age differences in prose recall have been reported and none has addressed this issue. Almost all of the extant studies have been oriented to investigating age-related deficits in the quantity of information remembered on recall tasks (Botwinick & Storandt, 1974; Gordon & Clark, 1974; Hulicka, 1966; Taub, 1975, 1976) and recognition tasks (Gordon & Clark, 1974; Taub, 1979).

However, the relationship between age group and prose learning and memory is not yet clear. For example, Taub and Kline (1978), in a repeated trials test of learning short paragraphs found no age differences until the third trial. In addition, Schneider, Gritz, and Jarvik (1975), examining verbatim recall of a short story presented auditorially, found age differences at the immediate interval but none after 1 week.

In contrast, Gordon and Clark (1974) found that elderly subjects remembered significantly fewer ideas from a prose passage as measured by recall and recognition tasks at both immediate and 1-week intervals; the difference in performance between old and young adults increased over time. The subjects in this study had high WAIS vocabulary scores. However, in a recent study by Taub (1979), no age-related deficit was found for older adults at moderately high WAIS vocabulary levels. Age-related decrements for both comprehension and memory tasks involving multiple-choice questions were only found for the older adults with lower WAIS vocabulary scores; Taub's findings pointed to both storage and retrieval deficits for this group of older adults.

A recent study by Cohen (1979) found deficits in older subjects on their immediate oral recall of an auditorially presented "story"

(similar to the Circle Island story used by Dawes, 1966). In particular, they were less likely to recall "gist" information than young people, and were much lower in their recall of the logical relationships among propositions (Cohen, 1979).

These findings by Cohen strongly suggest that differences in prose recall among different age groups are related to organizational factors. The present set of experiments is designed to test the relationship between age and recall with respect to two organizational properties of prose: its content structure and its top-level structure. These organizational variables are drawn from Meyer's prose analysis system (Meyer, 1975), and are described below.

The structure of a passage can be analyzed at a propositional level into a hierarchically arranged tree structure called the content structure (Meyer, 1975). The content structure displays the way in which the author of the passage has organized the information in the text. Information located at the top levels of this structure corresponds to the main ideas or gist of the passage, and information at low levels in the structure corresponds to details. Research has shown that information located at the top levels of the content structure of a passage is recalled and retained better than the information at lower levels of the structure (Meyer, 1975). This "levels effect" has been confirmed with various types of materials, recall tasks, and subjects ranging from elementary school children to graduate students (Kintsch & Keenan, 1973; Mandler & Johnson, 1977; Meyer, 1977; Thorndyke, 1977).

The first study to be reported investigates whether this levels effect in prose recall is found for all age groups. If older adults do

suffer an organizational deficit in memory, they may demonstrate less sensitivity to structural levels than younger adults. In addition, Rabbitt (1965) posits that older subjects are less able to ignore irrelevant stimuli. This would also lead to a diminished ability to distinguish levels of importance in prose passages. Such a distractibility theory would also predict that a higher proportion of details would appear in older subjects' recalls. It is also possible that age-related differences in recall might be explained by cultural related generational differences (Riegel, 1972; Schaie, 1970), such as schooling experiences.

The second study focuses on the very top level of a passage's content structure. Passages can be written with different types of superordinate organization or top-level structures (Meyer, 1979, Note 2). Meyer and Freedle (Note 1) have investigated the effects on recall of four top-level rhetorical structures, based on Meyer's (1975) prose analysis system: adversative, covariance, response, and attribution. An adversative structure compares a favored view to an opposing view; a covariance structure relates an antecedent to a consequent; a response structure relates a problem to a solution; and an attribution structure relates a collection of attributes to an event or idea. They found that discourse organized by these different types of top-level structures was differentially recalled, with the relatively tight structure of the adversative (comparative) relation facilitating recall over the looser attributive (descriptive list) structure, and the covariance and response structures falling in between (Meyer & Freedle, Note 1). Further studies have shown that subjects who are able to identify and use the top-level organizational structure of a passage will recall more of it than those who do not (Meyer, 1979, Note 2). This finding has held for samples of 9th graders (Bartlett, 1978; Brandt, 1978; Meyer, Brandt, & Bluth, in press; Swanson, 1979),

junior college students (Meyer, Rice, Bartlett, & Woods, Note 3), and graduate students (Meyer & Freedle, Note 1).

The facilitative effect of the adversative structure is attributed to its "tighter" organization which provides more interrelationships among its component parts than the "looser" list-type attribution structure. The adversative structure is thought to encourage learners to use strategies of comparing, contrasting, and finding interrelationships, which, in turn, enable them to process the information more deeply (Craik & Lockhart, 1972) and thus facilitate recall and retention. Figure 1, adapted from Meyer and Freedle (Note 1), depicts the differences in the organization of these two structures. A, B, and C represent portions of the content of a passage. The adversative structure chunks A, B, and C into two major components and relates these components both to a general topic and to each other through the relationship of comparison. In addition, in chunking B and C, an author has identified a relationship between B and C, such as C explains B. In contrast, the attribution structure relates A, B, and C to a general topic, but there are no relationships between A and B, B and C, or A and C.

Insert Figure 1 about here

In the second experiment reported here, subjects from three age groups read and recalled passages which were organized by either an adversative or an attribution type of top-level structure. If older adults experience an organizational deficit, they may be unable to utilize the superior adversative top-level structure and thus show no difference in their recall of the two discourse types.

GENERAL METHOD

The two experiments were conducted on the same occasion and used the same subjects and general procedures. The methods in common for the two experiments will be presented first. Next, each experiment will be described separately.

Subjects

Subjects were 48 paid volunteers, 30 female and 18 male. All were students or alumni of Arizona State University. The alumni were located through a computer search of ASU alumni files and were selected for telephone contact on the basis of age, sex, and commuting distance to the university testing site. The subjects were classified into three age groups with six males and ten females in each group. The ranges in age for these three groups were 20 to 33 for the young group, 41 to 55 for the middle group, and 58 to 79 for the old group. Table 1 presents further descriptions of the age groups with respect to age, years of schooling, and vocabulary subtest scores from the Wechsler Adult Intelligence Scale (WAIS). As seen in Table 1, the groups were equivalent in terms of years of schooling and vocabulary performance on the WAIS.

Insert Table 1 about here

Procedures

Subjects were tested individually and worked independently through their experimental booklets. The general instructions for the booklet were read aloud to the subjects as they read their own printed copies. Once they completed the tasks on a page in the booklet, they turned to the next section

and were instructed not to look back at previous pages. Every effort was made to make the subjects as comfortable as possible and reduce the anxiety of the testing situation. There were no time limits and an experimenter was present to answer any questions.

The subjects were instructed to read each passage through only once at their own speed. After reading it, they were instructed to write down as much as they could remember of the passage, using words from the passage or their own words. After each recall task, they were asked to provide a one-sentence summary of the passage and to fill in a partially completed outline of its main ideas.

Following the recall tasks, subjects completed a questionnaire which included demographic information, and then they rated their interest in reading articles about 25 different topics; these topics included the three topics of the passages read in the experiments. They rated these three topics at a level of moderate interest with no differences among the age groups. Upon completing the experimental booklet, an experimenter administered the WAIS vocabulary scale and then conducted an interview designed to probe attitudes towards reading and subjects' use of various organizational and memorial skills in every day life, and particularly in reading; several questions concerned the frequency with which they compared things and employed lists.

Scoring

The recall protocols were scored for idea units recalled by comparing them to the passage's content structure as analyzed by the Meyer (1975) system. Each protocol was scored for the presence or absence of the idea units identified by the content structure. The content structure depicts

all the information from a passage including the interrelationships among its ideas. One scorer evaluated all of the protocols; a reliability check with another trained scorer showed a correlation above .9 between the scorers. Detailed information about the scoring procedure and its reliability can be found in Meyer (1975).

EXPERIMENT 1: TYPE AND AMOUNT OF INFORMATION RECALLED

This study was designed to investigate the possibility of age-related differences in both the total amount of information remembered from everyday prose and the type of information remembered based on its position in the content structure. The passage used was sufficiently complex and long so that several levels of content structure could be differentiated. It had been previously utilized with college students, who recalled it (Meyer, 1975), and sixth graders, who answered questions (Meyer, 1977), to demonstrate the effects of levels in the content structure on reading and listening to prose. If older adults do suffer organizational deficits or an inability to ignore irrelevancies, this will be manifested in their recalls by differences in the relative proportions of ideas recalled from the different levels as compared to younger adults.

Method

Materials. The passage used was on the topic of parakeets as pets. It contains 641 words and 343 idea units at 17 discrete levels in the hierarchical content structure. Previous work with this passage entitled Parakeets: Ideal Pets, has been conducted by Meyer (1975, 1977), and the complete diagram of the content structure, the entire text, and the analytic procedures by which the content structure was developed can be found in Meyer (1975).

Twenty-six questions about the passage were written to tap information high or low in the content structure, with 13 questions from each category. The questions could be answered by a one- to three-word response.

Procedure. Prior to reading the passage on parakeets, each subject had read, recalled, and filled in an outline for two shorter passages on other topics (see Experiment 2). Thus, they were familiar with the reading and recalling procedures. The passage was recalled in writing. Next, they filled out the outline and then answered the questions on the passage.

Scoring. To examine the types of information recalled, the content structure was divided to identify equivalent thirds of the structure and crucial top-level information. The first division involved collapsing the 17 levels of the content structure into three structural categories, high, medium, and low, with approximately equal numbers of idea units. The high category contained levels one through seven of the content structure, totaling 100 idea units; the medium category contained levels eight through ten and 128 idea units; the low category contained levels 11 through 17 and 115 idea units. The high category contained the main ideas of the passage and the low category corresponded to less important, specific details. Information in levels one through five of the content structure appeared to be essential information for communicating the author's message and recall of this information was labeled as a subject's message score. This message involved the assertion that parakeets are ideal pets for people with limited space, time, and money.

The number of idea units was tallied from each of the high, medium, and low categories of structural levels. Then, the scores from these level categories were converted to proportions. The total number of idea

units recalled and a message score were also tallied for each subject. Correct answers to the outline and questions were recorded; substantive rather than verbatim scoring was employed throughout the study.

Results

Type and amount of information remembered. The proportions of idea units recalled from high, medium, and low levels in the content structure were analyzed with a three-factor analysis of variance (Age x Sex x Level, with Level as a repeated measure) followed by multiple contrasts with Tukey tests at the $p < .05$ level. As seen in Table 2, level was the only statistically significant main effect. The highly significant ($p < .0001$) level effect indicates that taken as one group, the subjects show differential recall of the levels of information in the prose structure. As expected, the highest level in the content structure is best remembered as shown in Table 2. The Tukey test showed that the high level was recalled significantly better than either the medium or low structural levels ($p < .01$), but that the lower two levels did not differ significantly.

Insert Table 2 about here

The age x level interaction closely approached statistical significance ($p = .053$). A Tukey test showed that the only statistically significant difference in levels occurred for the young age group. As with the group as a whole, the young group's recall of high level information was significantly better than their recall of medium or low level information ($p < .01$), but there was no significant difference between the medium and low levels. However, the levels did not differ significantly for the middle

nor the old age groups. Thus, all three age groups showed similar trends in their recall of information from the different levels of the prose structure, but the differences between high and lower level information were greater for the young adults. They appear to be more sensitive to the hierarchical organization of the passage than the middle and old adults.

A three-factor analysis of variance (Age x Sex x Level, with repeated measures on Level) was conducted on the number of correct answers to the questions about the passage. As seen in Table 2, the significant findings were the level effect ($p < .0001$) and the age x level interaction ($p < .01$). Figure 2 displays this interaction. As in the free recall task, the young group differentiated between levels to a greater degree than did the older groups. While all three groups could answer most of the questions about the superordinate information, the young subjects were less able to answer questions on details. These findings indicate that there are age differences in what kinds of information are encoded and stored in memory from a passage.

Insert Figure 2 about here

The free recall data on the first five levels in the content structure parallels the findings on the questions tapping high level information. A two-factor analysis of variance (Age x Sex) was employed to examine recall of the passage's message. As seen in Table 2, again there were no differences among the age groups in recall. It appears that the ability to retain the main ideas or gist is present for all age groups. This is substantiated by data from the outline completion task on which there were

no age differences. An unexpected sex effect ($p < .01$) can be seen in Table 2. There was no interaction between age and sex on recall. This sex effect was not found in Experiment 2, and was not related to vocabulary scores nor to subjects' ratings of their interest in the passage topic.

While all age groups recalled the very top-level information, the author's message, there were age differences in the types of information recalled at other levels in the structure as can be seen in Table 3. As shown in the table, the young adults recalled more ideas that directly support the author's message: Parakeets are ideal pets for people with limited space, time, and money. This information was located at approximately level six in the content structure. On an average, over half of the young adults remembered these supporting, major details, while less than half of the two older groups remembered them. Analysis of responses to the questions tapping information from these major details supports these findings. The average number of errors on these questions were three, six, and eight for the young, middle, and old groups, respectively.

Insert Table 3 about here

In contrast, the types of passage information where the middle and old groups outperformed the young group are shown in Table 3 under minor details. As can be seen from the descriptions of the information given in the table, these ideas consisted of minor details not essential to the author's message. The question data also corroborate these recall data and point to differential acquisition of passage information. The average

number of errors on questions tapping these minor details were 11, 6, and 5 for the young, middle, and old groups, respectively.

Discussion

The findings do not demonstrate an age-related deficit in the amount of information remembered from prose. Although the literature on this issue is mixed, these data are contrary to the majority of studies. As Experiment 2 produced similar findings, the issue of quantity of recall will be addressed in the General Discussion section.

Although no age differences were found in the amount of information remembered, there was an interaction between age and type of information remembered on both the recall and question tests. While similar trends were found in the pattern of recall, that is, all age groups tended to remember more high level information than lower level information, the difference in recall of these two types of information was greatest for the young age group. The middle and older groups did not demonstrate the levels effect; that is, high level information was not recalled significantly better than low level information. Recall of the message or major thesis in the expository text was equivalent for all age groups. However, the young group was more sensitive to the hierarchical structure of the prose than the older age groups.

These data can be used to support explanations which posit a deficit in the older groups' ability to use organization (Craik, 1968), and the older subjects' greater distractibility or inability to distinguish the irrelevant from the important information (Rabbitt, 1965). These explanations can be supported by the greater number of low level (detail) ideas recalled and questions answered correctly by the older subjects. However,

it is important to note that the middle age group's performance was almost indistinguishable from that of the older group. Thus, rather than postulate aging deficits beginning at age 40, it would seem more appropriate to consider those characteristics which make the youngest group different from the other adults.

An explanation for the particular sensitivity to levels of information in young subjects may lie in the particular requirements of schooling, in which all were engaged at the time of testing. Reading for school purposes requires that special attention be paid to the author's message, irrespective of the reader's own interest in the material. The hierarchical nature of the content structure is built on the basis of the author's perspective of what is important in a passage (Meyer, 1975, 1979, Note 2). Thus, sensitivity to the hierarchical levels of the content structure of a passage may be heightened by the activity of schooling.

The interview data support this explanation. The young group of subjects reported more current familiarity with classroom texts and tasks. All young subjects reported using outlining, while only about half of those in the middle and older groups did ($\chi^2 = 12.3$, $p < .01$). When asked about their recall strategies in this particular experiment, about half of the middle and older groups and one-fourth of the young group reported that they "just wrote all they could." The other subjects all reported some conscious organizational strategy employed either during reading or during the recall process. These factors are consonant with the younger groups' greater sensitivity to the hierarchical levels of content structure in the passage presented. In addition, the fact that they reported greater use of conscious organizational strategies as they read and recall text is probably an adaptation to school.

Following the author's perspective on what is important to encode and retrieve from the passage appears to be the strategy employed by the young adults. The older groups, while still picking up the author's message, appear to use other strategies based more on their particular interests. In addition, changes in schooling practices may be partially responsible for the different patterns of recall found. Older subjects may have been specifically taught to look for and remember names, dates, and other details. Informal interview data support this hypothesis, which is being investigated further.

EXPERIMENT 2: USE OF DIFFERENT TOP-LEVEL STRUCTURES, ORGANIZATION AND QUANTITY OF RECALL

This study was designed to determine whether older subjects exhibit differential recall of prose which is organized according to different top-level structures. The top-level structures selected were the two which differed most from each other in the Meyer and Freedle (Note 1) study. In that study, young adults in graduate school who listened to the adversative passage performed substantially better on immediate and delayed free recall tests and questions than students who listened to the attribution passage. In a pilot study (Meyer & Walker, Note 4) with retired old adults living in a mobile home park, recall from the adversative passage was not superior to recall of the attribution passage. This suggests that an organizational deficit may preclude these older subjects from taking advantage of the superior organizational properties of the adversative structure. Experiment 2 is an attempt to replicate these findings.

Method

Materials. Two versions of each of two passages were prepared. One passage originally used by Meyer and Freedle (Note 1) on the topic of loss of water from the human body (dehydration), consisted of 141 words and 66 identical idea units for each version. The other passage was on the topic of whales and contained 205 words and 126 identical idea units. For each of these passages an adversative and an attribution version was prepared. These versions presented the same information, but they were organized in different ways as shown in Figure 1. The adversative passage presented the information as two different opinions about the same subject, with one position favored and the other disfavored. The attribution version presented the information as a list of items or characteristics of the passage topic. Thus, the adversative and attribution versions of each passage were written with identical content and structure except for the top-level structure (or discourse type) and the relatively few content units necessary for altering the top-level structure. The procedure used to write the passages and insure their identical structures and content was the prose analysis procedure which is described in detail by Meyer (1975).

More specifically, the following presents the adversative and attribution passages on the topic of dehydration. The top-level structure and different content are capitalized, while the identical information is in lower case letters. ("A" in Figure 1 corresponds to the identical information in the first paragraph of each passage, while "C" in Figure 1 corresponds to the identical information in the last paragraph of each passage.) The capitalized and underlined words in the text are the different

content words in the two passages. The capitalized words without underlining explicitly signal (Meyer, 1975) the top-level structure of each passage and the explanation relationship between the different content (B in Figure 1) and the identical (C) information in the adversative passage.

Adversative Passage

The loss of body water is frequently required by athletic coaches of wrestlers, boxers, judo contestants, karate contestants, and 150-pound football team members so that they will attain specified body weights. These specified weights are considerably below the athletes' usual weights.

IN CONTRAST TO ACTION TAKEN BY COACHES LOSS OF BODY WATER FOR ATHLETES IS STRONGLY CONDEMNED BY THE AMERICAN MEDICAL ASSOCIATION. THEY CONDEMN LOSS OF BODY WATER DUE TO THE FACT THAT THE loss of body water impairs cardio-vascular functioning limiting work capacity. More specifically, a loss of three percent of body water impairs physical performance and a loss of five percent results in heat exhaustion. Moreover, a loss of seven percent of body water causes hallucinations. Losses of ten percent or more of body water result in heat stroke, deep coma, and convulsions; if not treated death will result.

Attribution Passage

SEVERAL ASPECTS OF THE LOSS OF BODY WATER WILL BE DISCUSSED. FIRST, the loss of body water is frequently required by athletic coaches of wrestlers, boxers, judo contestants, karate

contestants, and 150-pound football team members so that they will attain specified body weights. These specified weights are considerably below the athletes' usual weights.

SECOND, THE LOSS OF BODY WATER SUSTAINED BY A 150-POUND INDIVIDUAL EACH DAY IS THREE PINTS OF WATER.

THIRD, loss of body water impairs cardio-vascular functioning limiting work capacity. More specifically, a loss of three percent of body water impairs physical performance and a loss of five percent results in heat exhaustion. Moreover, a loss of seven percent of body water causes hallucinations. Losses of ten percent or more of body water result in heat stroke, deep coma, and convulsions; if not treated death will result.

Procedure. Each subject read and recalled in writing one passage of each content and of each top-level structure. Within each of the three age groups, subjects were randomly assigned to each of the four possible presentation orders, except that distribution by sex was also considered. After each written recall, subjects filled in an outline of the passage just read.

Scoring. As in Experiment 1, the recall protocols were scored for the number of idea units recalled; since the dehydration and whale passages differed in number of idea units, the data were converted to proportions. In addition, each protocol was classified according to the top-level structure used by the subject to organize his or her recall. The categories were as follows: adversative, attribution, a different top-level structure (i.e., covariance-causal), or no apparent structure. According

to whether the structure in the recall matched that found in the passage read by the subject, the protocols were classified into two categories: those where the same top-level structure as present in the text was employed and those where a different top-level structure was used. Agreement between independent scorers in categorizing protocols was above .9.

Results

The recall data were analyzed using a four-factor analysis of variance (Age x Order of Presentation x Discourse Type x Passage Topic) with the latter two factors as repeated measures. Table 4 displays a summary of the findings for the factors of primary interest. There was no overall age effect ($F_{2, 36} = .73$). The main effect of presentation order was statistically significant ($F_{1, 36} = 17.83$, $p < .001$) with the second passage (.56) read being remembered better than the first passage (.47). The effect of discourse type closely approached statistical significance ($F_{1, 36} = 3.64$, $.05 < p < .064$); the trend was for superior performance on the adversative versions of the passages (.54) than the attribution versions (.49). This finding was due to performance on the first passages read where the mean proportion recalled was .52 for the adversative versions and .41 for the attribution versions ($F_{1, 36} = 3.81$, $p = .059$). However, the interaction between discourse type and order was not significant ($F_{1, 36} = 2.06$, $p < .160$). Passage topic was significant ($F_{1, 36} = 9.01$, $p < .005$) with a greater proportion of ideas recalled (.55) from the shorter dehydration passages than the longer whale passages (.48). However, there were no significant interactions between passage topic and any of the other factors.

In addition, none of the other interactions among the factors reached statistical significance. However, the data suggested a trend towards an interaction between age and order ($F_{2, 36} = 2.95$, $.05 < p < .065$) with the middle and older groups performing poorer on the first recall than the young group, but more closely approximating the young group's performance on the second passage. As seen in Table 4, the only age group differences of any magnitude occur for the attribution versions on the first reading and recalling task.

Regarding the top-level structures of the recall protocols written by the subjects, there were no significant differences among the age groups in use of structure ($\chi^2 = 3.13$, n.s. for Adversative; $\chi^2 = 1.20$, n.s. for Attribution Passages). All but one of the protocols had some type of organization, primarily either adversative or attribution; only two were organized with an entirely different structure, that of covariance (causal). Although most subjects used the same type of top-level structure as employed in the passage they read, they were more likely to change structures in favor of an adversative structure than in favor of an attribution structure ($\chi^2 = 12.17$, $p < .001$).

The age groups did not differ significantly on passage summaries or listing of main ideas. Each age group reported similar use of comparison and listing strategies; most subjects reported frequent use of these strategies in their daily routines.

Discussion

It is clear that the strongest single factor affecting how much was recalled from a passage was order, that is, whether it was the first or second passage that the subject encountered. As can be seen in Table 4,

such age and discourse type effects as existed in the recall of the first passage disappeared with the second.

The large increase in recall of the second passage as compared to the first passage presented can be interpreted as a practice effect. The first passage served to familiarize the subjects with the task requirements, thereby improving their performance on the second passage. In particular, the outline-completion and summarization tasks may have suggested memory strategies which subjects were able to successfully employ in the following recall task. Anecdotal evidence for this interpretation can be found in the interviews following the experiment, during which a number of subjects indicated that their strategies changed after the first passage was read and that they began to "make mental notes" or "outlines" in their heads.

An important aspect of this presentation order or practice effect is that it is age related. The young group shows very little difference in performance, while the middle and older groups both show marked improvement on the second recall. The explanation for this probably lies in the fact that the young group consisted of students, who are likely to be familiar with the general requirements of this sort of recall task. The data suggest that older adults can perform as well as younger ones on a prose recall task once they understand its requirements.

Overall, the data provided no support for claims of deficits in prose learning nor in use of organization with aging. Differences were not found among the age groups in amount of information remembered nor in ability to utilize the adversative and attribution structures. Responses to interview questions designed to elicit information about everyday

activities showed no significant differences among age groups with respect to hours spent reading, types of materials read, list making or contrasting activities. Our subjects appear to have been a relatively homogeneous group of college educated adults. As suggested by Taub's (1979) findings, age related deficits in reading may be apparent with less verbal groups of adults but not with those of higher verbal skills.

In regard to the investigation into the effects of discourse types on recall, the study provided very limited support for the findings reported by Meyer and Freedle (Note 1). The adversative top-level structure did appear to facilitate recall over the attribution structure on the first recall, particularly for the middle and older age groups. This finding is consonant with that of Meyer and Freedle (Note 1). However, nothing in their argument suggests that this differential will disappear after the first trial. In addition, the recall differences between the two structures was greater for their group of young adults than for the young adults here. A possible explanation for the relatively greater differential in recall between discourse types reported in that earlier study may lie in the use of different presentation methods. Meyer and Freedle had their subjects listen to the passages, thus constraining their processing time, while subjects in this study were free to read as slowly as they chose. When given unlimited presentation time in prose learning experiments, college students may search for interrelationships and compare ideas regardless of the presence of an adversative structure which facilitates the use of these strategies. However, with limited presentation time, less time is available to apply these strategies to text unless the text suggests them and its organization readily matches them. Our

older adults who were no longer students may not have actively applied these strategies of the first task due to their unfamiliarity with task demands. On this task they may have been more dependent on the organization inherent in the text, and as a result performed better on the adversative passages. However, when familiar with the recall and summarization demands of the task they may have spent more time identifying and examining interrelationships when reading the attribution passages. A study in which presentation time is manipulated is being undertaken to test this explanation.

GENERAL DISCUSSION

No age-related deficit in the quantity of information recalled from prose was found in either experiment. These findings are in contrast to the majority of previous studies. Explanations of these differences may lie in several factors: task familiarity, vocabulary level of subjects, and the quality of the prose.

A finding of an age-related practice effect is of potential significance for studies of prose recall. Almost all of the previous studies of prose recall by older subjects which have found deficits with age have used a single passage (Cohen, 1979; Gordon & Clark, 1974; Schneider, Gritz, & Jarvik, 1975). An exception is Taub and Kline (1978) who gave three passages (four trials each) to each subject. Significantly, they found no age-related differences in immediate recall of key words when data from the three passages were considered together. In addition, their subjects had participated in earlier memory experiments, and were thereby familiar with the procedures and requirements. Thus, it may be that studies which report memory deficits in the aged on the basis of recall from a single

passage may, in fact, be identifying a lack of familiarity with task demands.

With respect to vocabulary level and quantity of recall, Taub (1979) found no age differences in prose learning for older adults with high WAIS vocabulary scores. The subjects in the present study fall within Taub's high vocabulary level. In addition, Taub's prose materials, adapted from standardized reading tests on such topics as pollution and forces of nature, are more similar to the passages used in this study than to many of those employed in past studies. The parakeet passage, particularly, and Taub's passages are indistinguishable from everyday expository prose. However, some of the passages used in past studies appear to be more experimenter-contrived and artificial. For example, Cohen (1979) and Gordon and Clark (1974) found age-related deficits with passages modeled after Dawes' (1966) Circle Island passage; these passages contain ten logical set relationships between five groups of people. Passages of this type are rarely encountered in ordinary reading materials. The findings of the present study, in combination with Taub's findings, suggest that such age-related deficits in information processing as may exist are minimized for older adults with above average vocabularies in familiar situations with materials that are compatible with their everyday reading experiences.

The findings also do not provide much support for the notion of an organizational deficit in older adults, though interpretations are less clear for this issue. On the one hand, no age differences were found in either experiment in use of the top-level structure of the passages, nor in ability to produce summaries and fill in outlines with main ideas. In

addition, older subjects were as able as young ones to use the tightly organized adversative top-level structure.

These findings are in contrast to those of Cohen (1979) who found deficits with age in ability to recall gist information. However, they do not necessarily conflict with her interpretation of her findings as representing limited processing capacity in older adults (Cohen, 1979). She presented her passage orally, constraining processing time, while subjects in the present studies were given unlimited time in which to read and process the passages. It may be that deficits emerge only when processing time is constrained.

While all age groups picked up the author's main idea, age differences were found in the types of information recalled at other levels in the content structure. The young group was most sensitive to the hierarchical structure of the passage and focused on the major details which supported the author's thesis. In contrast, both the middle and older groups picked up the main idea, but then focused on tangentially related details which were of interest to them but not essential for the author's thesis. Only the youngest group showed the expected levels effect. Because the middle and older groups showed equivalent recall patterns and performed as well as the young group on the other measures of organization, it seems more appropriate to attribute the difference in type of information recalled between the older groups and the young group to different reading strategies employed by the age groups rather than to organizational deficits or greater distractibility of the older age groups.

Some data from a study (Meyer, Note 5) on the effect of <u>explicit</u> cues to the author's perspective (signaling) support this explanation concerning

reading strategies. Signaling (Meyer, 1975) includes such things as repetition of main ideas, explicit statement of the top-level rhetorical structure of the passage, and statements like "this is an important point." Signals focusing on the hierarchical structure had no effect on the total amount of information recalled by college students and retired adults, but for the retired adults they affected the type of information recalled. Regardless of signaling, the college students employed the strategy used by the young subjects in the present experiment; there were large differences between the recall of high and lower level information. With signaling the pattern of recall of high and low information for the retired adults looked like that of the students. However, without signaling, the number of main ideas recalled decreased while the number of details increased; the pattern of recall looked similar to the older age group's recall in Experiment 1. The parakeet passage used in Experiment 1 has very little signaling (14 out of 641 words), while this passage contained much more (26 out of 242 words). These data suggest that older adults can alter their reading strategies and are capable of greater sensitivity to the hierarchical prose structure if it is clearly signaled.

To determine the exact nature and genesis of the reading strategies employed by different age groups will require further study. It would seem, however, that an explanation based on schooling differences among the groups is the most parsimonious. Current schooling practices may teach readers to focus on the gist and author's rationale for a position, while the schooling which older groups received may have emphasized recall of detail. In addition, experiences after completion of school may encourage adding more details (i.e., experience with recipes, instruction manuals),

or simply a focusing on ideas of relevance to self rather than the text author.

In summary, no age-related deficit was found in the amount of information remembered, recall of the passage's message, nor use of top-level structures. These findings are contrary to the majority of studies which have examined aging effects with prose materials. Several variables may be responsible for the diversity of findings in this research area. These include the learner variables of verbal ability (as measured by vocabulary) and familiarity with task demands, as well as the task variables of presentation mode (oral or written), response mode (recall or recognition), and type or naturalness of the prose used. Under the conditions of the present studies, in which high vocabulary adults read and recalled typical expository prose, a deficit model of aging for prose recall does not seem appropriate. Instead, research directed toward identifying the different reading strategies employed by each age group is needed.

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Footnotes

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[2]We would like to thank Catharine Knight for her special concern and work with the subjects and Janice Jessen for her assistance in scoring their recall protocols.

[3]Requests for reprints should be sent to Bonnie J. F. Meyer, Department of Educational Psychology, Arizona State University, Tempe, Arizona 85281.

Table 1

Mean Age, Years of Schooling, and Vocabulary Scores of Subjects in Young, Middle, and Old Age Groups

	Age Group		
	Young	Middle	Old
Age	23.13 (3.61)[a]	47.00 (3.56)	68.56 (6.08)
Years of Schooling ($F_{2, 45} = .20$, n.s.)	15.25 (1.18)	15.50 (1.56)	15.38 (1.03)
Vocabulary ($F_{2, 45} = 1.08$, n.s.)	56.13 (12.49)	62.25 (12.12)	58.38 (11.04)

[a]Standard deviations are presented in parentheses.

Table 2

Experiment 1 Summary Statistics for Major Findings of the Analyses of Variance

		Mean	SD	F	df	p
Proportion of Idea Units Recalled from High, Medium, and Low in the Structure						
Age:	Young	.34	.07	1.06	2/42	n.s.
	Middle	.34	.16			
	Old	.29	.15			
Sex:	Male	.28	.11	2.85	1/42	n.s.
	Female	.35	.14			
Level:	High	.43	.17	40.53	2/84	.0001
	Medium	.30	.13			
	Low	.27	.16			
Age x Level				2.45	4/84	.053
Number of Questions Correct						
Age:	Young	9.25	1.70	.08	2/41	n.s.
	Middle	9.67	2.14			
	Old	9.69	1.92			
Sex:	Male	9.33	1.68	.32	1/41	n.s.
	Female	9.66	2.03			
Level:	High	11.19	1.70	97.35	1/41	.0001
	Low	7.87	2.68			
Age x Level		See Figure 2		4.93	2/41	.01
Idea Units Recalled at Levels 1-5 in the Structure						
Age:	Young	29.50	8.22	1.87	2/42	n.s.
	Middle	25.63	11.95			
	Old	23.19	9.50			
Sex:	Male	21.50	7.70	6.89	1/42	.01
	Female	28.87	10.53			

Table 3

Mean Recall by Each Age Group (N = 16) of Ideas Which Support the Message of the Passage (Major Details) and Ideas Which Do Not (Minor Details)

	Level in Structure	Age Groups		
		Young	Middle	Old
Major Details Which Support the Message				
Evidence supporting the assertion that parakeets are ideal pets for people with limited *space* (11 idea units)	5 (4-5)[a]	11 (2.5)	9 (1.8)	6 (2.5)
		$F_{2, 30} = 12.99$, $p < .01$		
Evidence supporting the assertion that parakeets are ideal pets for people with limited *time* (18 idea units)	5 (4-6)	9 (2.7)	6 (2.1)	4 (2.0)
		$F_{2, 51} = 19.86$, $p < .01$		
Evidence supporting the assertion that parakeets are ideal pets for people with limited *money* (27 idea units)	7 (4-9)	10 (2.2)	7 (2.7)	8 (3.2)
		$F_{2, 78} = 6.80$, $p < .01$		
Summary for major details: Evidence concerning space, time, and money (56 idea units)	6 (4-9)	9.64 (2.44)	7.11 (2.54)	6.20 (3.04)
		$F_{2, 165} = 24.52$, $p < .01$		
Selection of Minor Details Which Do Not Support the Message				
Specifics on colors of parakeets and appearance of color mutations (16 idea units)	12 (11-13)	3 (1.7)	5 (2.0)	5 (1.6)
		$F_{2, 45} = 9.37$, $p < .01$		

Table 3 (continued)

	Level in Structure	Age Groups		
		Young	Middle	Old
Date (1840) Gould brought parakeets to England (2 idea units)	15	5	6	11
Specific conditions when cages other than from stores are best (i.e., thoroughly washed cage from garage sale) (8 units)	11 (10-11)	2 (1.1)	3 (1.5)	5 (1.1)
		$F_{2, 21} = 16.63$, $p < .01$		
Specific sources of calcium (3 units)	9 (9)	3 (1.5)	5 (3.1)	6 (1.2)
		$F_{2, 6} = 0.95$, n.s.		
Description of birds' behavior with greens (i.e., They enjoy chomping on wet and tasty greens) (11 units)	14 (13-14)	2 (2.2)	5 (4.3)	3 (2.0)
		$F_{2, 30} = 3.22$, n.s.		
Summary for minor details (40 idea units)	12 (9-14)	2.30 (1.84)	4.63 (2.84)	4.63 (2.23)
		$F_{2, 117} = 13.21$, $p < .01$		

[a]Numbers in parentheses are ranges for level and standard deviations for age groups.

Table 4

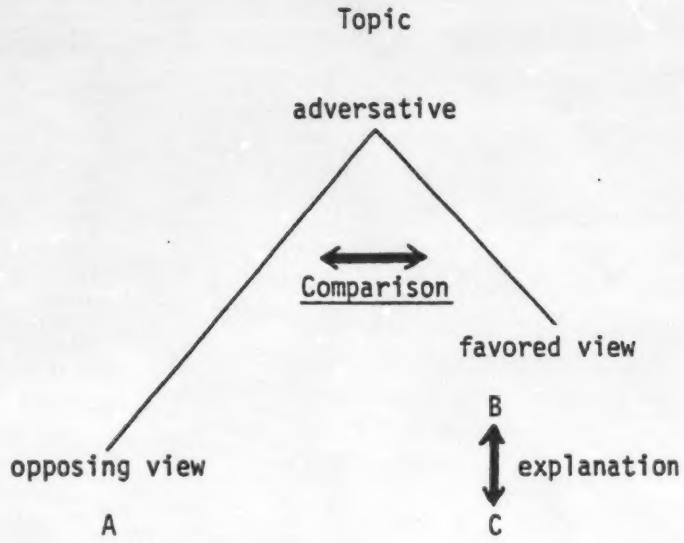
Mean Proportion of Idea Units Recalled from the Adversative and Attribution Passages Read in First and Second Orders by the Three Age Groups

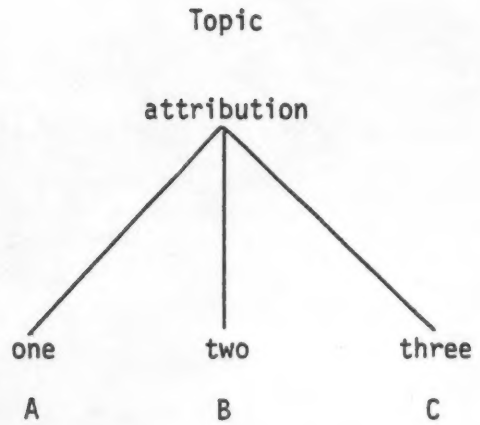
	Order of Presentation			
	Read First		Read Second	
	Discourse Type		Discourse Type	
Age Groups	Adversative	Attribution	Adversative	Attribution
Young	.56	.52	.56	.56
Middle	.48	.38	.58	.58
Old	.53	.34	.52	.56

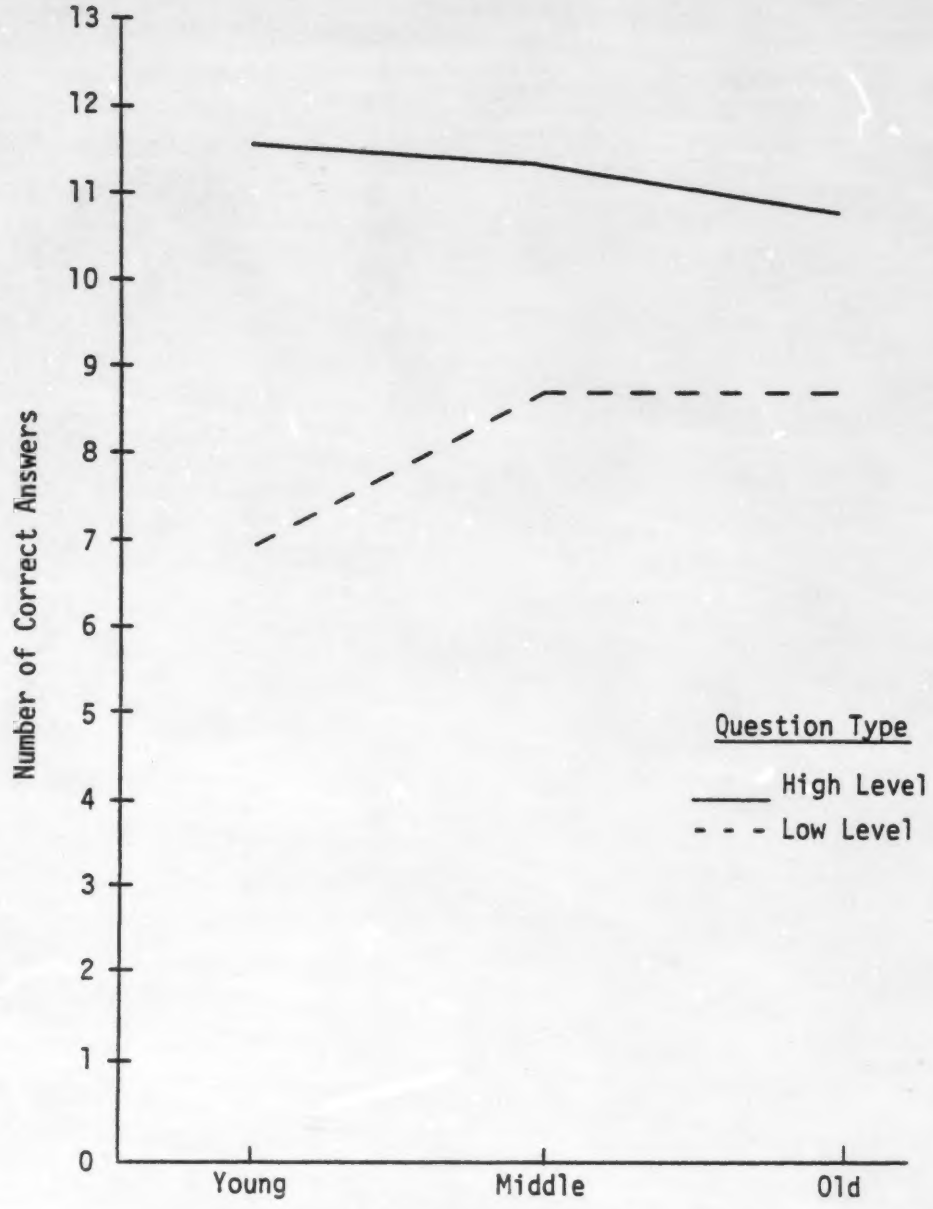
Figure Captions

Figure 1. Differences in organization and relationships between the two top-level structures.

Figure 2. Number of correct answers to high and low level questions about the passage by young, middle, and old adults.


Topic
adversative
Comparison
favored view
B
opposing view
explanation
A
C


Topic
attribution
one
two
three
A
B
C


13
12
11
10
9
8
7
6
5
4
3
2
1
0
Number of Correct Answers
Young
Middle
Old
Question Type
High Level
Low Level